

2. The apparatus of claim 1, wherein said processing island is an inspection station for inspection of the substrate.

C2
3. (Twice amended) The apparatus of claim 1, wherein said [processing island includes a load lock chamber and a] processing chamber is separated from the conveyor by the load lock chamber.

4. (Amended) The apparatus of claim 1 [3], wherein said load lock chamber is a heating or cooling chamber.

5. (Amended) The apparatus of claim 1 [3], wherein said processing chamber includes one or more chambers configured to perform at least one process, or a combination of processes, selected from a group of a CVD process, a PECVD process, an etching process, a cleaning process, a descumming process, a PVD process, and a post-anneal process[, or a combination thereof].

6. The apparatus of claim 3, wherein said processing island includes two processing chambers.

7. The apparatus of claim 1, wherein said conveyor includes a plurality of substrate holding elements.

8. The apparatus of claim 1, further including at least one substrate stacker to hold substrates prior to or after processing.

9. The apparatus of claim 1, wherein said substrate transfer mechanism includes an end effector for supporting the substrate, a horizontal linear actuator for horizontally translating the end effector, and a vertical linear actuator for vertically translating the end effector.

10. The apparatus of claim 9, wherein the end effector is fork-shaped.

C3 11. (Amended) The apparatus of claim 9, wherein said substrate transfer mechanism [further] includes a vertical rotary actuator for rotating the end effector about a vertical axis.

12. The apparatus of claim 1, wherein said substrate transfer mechanism is moveable from a position directly below the substrate on said conveyor when the substrate is in a stopped position adjacent said processing island, to a position engaging the substrate, and then to a final position wherein the substrate is positioned above the conveyor.

13. The apparatus of claim 1, wherein said processing island includes an entry load lock chamber, a processing chamber and an exit load lock chamber.

14. The apparatus of claim 13, wherein said entry load lock chamber is a heating chamber and said exit load lock chamber is a cooling chamber.

15. (Twice amended) An apparatus for performing a thin film process on a substrate, comprising:

a conveyor to support one or more substrates [a substrate as it moves along a flow path];

a plurality of processing islands located adjacent the conveyor [along the flow path], each processing island comprising [including]:

[an exterior, an interior, and at least one valve for exchange of the substrate between the exterior and the interior;]

a first load lock chamber having a first valve for introduction of a substrate therein;

a processing chamber in communication with said first load lock chamber; and

a second load lock chamber in communication with said processing chamber and having a second valve for extraction of a substrate therefrom; and

a substrate exchange apparatus configured and arranged to retrieve [the] a substrate from the conveyor, introduce the substrate into [the] an interior of a selected processing island, extract the substrate from the interior of the selected processing island, and replace the substrate on the

conveyor.

16. (Amended) The apparatus of claim 15, wherein [each one of said plurality of processing islands includes:

a first load lock chamber having a first valve for introduction of the substrate therein;

Cy Ant
a] at least one of the processing chambers is separated from the conveyor by at least one of the load lock chambers [in communication with said first load lock chamber; and

a second load lock chamber in communication with said processing chamber and having a second valve for extraction of the substrate therefrom].

17. (Amended) The apparatus of claim [16] 15, wherein said first load lock chamber is a heating chamber and said second load lock chamber is a cooling chamber.

18. The apparatus of claim 15, wherein the substrate exchange apparatus includes:

a first robot for retrieving the substrate from the conveyor and introducing the substrate into the interior of the selected processing island; and

a second robot for extracting the substrate from the interior of the selected processing island and positioning the substrate on the conveyor.

19. The apparatus of claim 15, wherein the substrate exchange apparatus includes:

a loader having an end effector for retrieving the substrate from the conveyor and introducing the substrate into the interior of the selected processing island; and

an unloader having an end effector for extracting the substrate from the interior of the selected processing island and positioning the substrate on the conveyor.

20. The apparatus of claim 19, wherein the end effector has the shape of a fork.

21. (Amended) The apparatus of claim 15, wherein the conveyor forms [flow path is] a

C5

continuous loop.

22. The apparatus of claim 15, wherein the conveyor has a plurality of individual holding elements, each for holding a substrate.
23. The apparatus of claim 22, wherein the pitch between adjacent individual holding elements and the pitch between adjacent chambers in a processing island is substantially uniform.
24. The apparatus of claim 23, wherein the pitch between adjacent individual holding elements is substantially equal to the pitch between adjacent chambers in each of said plurality of processing islands.
25. The apparatus of claim 23, wherein the pitch between adjacent individual holding elements is substantially equal to the pitch between adjacent chambers in at least one of said plurality of processing islands.
26. The apparatus of claim 22, wherein each holding element is formed as a pallet configured to centrally support a substrate, and the substrate exchange apparatus includes at least one frame for supporting the substrate about a perimeter thereof, the frame configured to be moved from a first position below the pallet to a second position above the pallet for acquiring the substrate from the pallet, the frame having a perimeter gap to permit passage of a pallet support element during exchange of the substrate between the pallet and the frame.
27. The apparatus of claim 22, wherein each holding element has a C-shaped structure with a first substrate holding moiety forming a top of the C-shaped structure.
28. (Twice amended) An apparatus for performing thin film processing on substrates, comprising:

[at least one] a plurality of processing islands arranged along a work flow path, wherein

each [the] processing island [including:] comprises an exterior, an interior, and at least one valve for exchange of a selected [one] number of the substrates between the exterior and the interior thereof;

a substrate delivery and removal system;[and]

a track which is adjacent to the work flow path; and

6 Art
a substrate exchange apparatus to retrieve the selected [one] number of the substrates from the substrate delivery and removal system, introduce the selected [one] number of the substrates into the interior of the processing island, extract the selected [one] number of the substrates from the processing island, and return the selected [one] number of the substrates to the delivery and removal system;

wherein the substrate exchange apparatus is moveable along the track [work flow path] between a first position at which the selected [one] number of the substrates can be retrieved from the delivery and removal system[; or returned to the delivery and removal system, and an exchange position at which the selected [one] number of the substrates can be transferred between the interior and exterior of the plurality of processing [island] islands.

29
30. (Twice amended) The apparatus of claim 28, [further comprising a plurality of processing islands and a track extending along the work flow path between the first position and a second position at a location “distal from the exchange position”, the track passing adjacent to each of said processing islands and the substrate exchange apparatus moveable along the track between the first position and the second position] wherein at least one of the processing islands includes at least one processing chamber separated from the substrate delivery and removal system.

30
31. (Amended) The apparatus of claim 28 [30], wherein the track has a first terminus at the first position and a second terminus at the second position.

32
32. (Amended) The apparatus of claim 28 [30], wherein the track has a first side and a second side, and the processing islands lie along the first and second sides of the track.

33. The apparatus of claim 28, wherein the substrate delivery and removal system includes:
a plurality of cassettes to hold a plurality of substrates; and
a cassette loading system to position the substrates on the cassettes.

35. (Amended) The apparatus of claim 28, wherein there are a plurality of processing islands, each including:

a first load lock chamber having a first valve through which the selected [one] number of the substrates can be introduced therein; and
at least one processing chamber;
wherein for each processing island, said substrate exchange apparatus may be moved to at least one exchange position to introduce the selected [one] number of the substrates into the first load lock chamber.

36. The apparatus of claim 35, wherein said processing chamber includes one or more chambers configured to perform at least one of a CVD process, a PECVD process, an etching process, a cleaning process, a descumming process, a PVD process, a post-anneal process, or a combination thereof.

37. (Amended) The apparatus of claim 28 [30], wherein the second position is a service position at which the substrate exchange apparatus is accessible for maintenance or replacement.

38. (Twice amended) An apparatus for performing thin film processing on substrates, comprising:

a substrate delivery and removal system;

a processing island including:

a first load lock chamber having a first valve by which a substrate can be introduced into the first load lock chamber;

at least one processing chamber, and

a second load lock chamber having a second valve by which a substrate can be extracted from the second load lock chamber; and

a substrate exchange apparatus to retrieve substrates from the delivery and removal system, introduce substrates into the first load lock chamber, extract substrates from the second load lock chamber, and return substrates to the delivery and removal system, wherein the substrate exchange apparatus is moveable between:

390
37
39

a first position at which substrates can be retrieved from the delivery and removal system;

an introduction position, remote from the first position, at which substrates can be introduced into the first load lock chamber; and

an extraction position, remote from said first position and said introduction position, at which substrates can be extracted from the second load lock chamber;

wherein the substrate exchange apparatus is moveable along a track which runs between the first position, the introduction position and the extraction position, and is adjacent to said processing island.

39. (Twice amended) The apparatus of claim 38, [further comprising a track extending among the first position, the introduction position and the extraction position, and passing adjacent to said processing island, the substrate exchange apparatus being moveable along the track] wherein the processing chamber is separated from the substrate delivery and removal system by at least one of the load lock chambers.

39. (Twice amended) An apparatus for performing thin film processing on substrates, comprising:

first and second conveyors on which substrates can be supported as they move in respective first and second flow paths;

a plurality of processing islands associated with the first and second flow paths and each processing island including:

an exterior,

an interior, and

at least one valve to exchange substrates between the exterior and the interior;

an apparatus associated with each processing island by which substrates can be retrieved

from the conveyor, introduced into the interior of the processing island, extracted from the processing island, and transferred to the conveyor; and

at least one bypass robot by which substrates can be acquired from a first location along the first flow path and transferred to a second location along the second flow path, the bypass robot including:

an end effector to engage substrates;

a first actuator to vertically translate the end effector;

a second actuator to rotate the end effector about a vertical axis; and

a third actuator to horizontally translate the end effector.

C90 *3C1* *41.* (Twice amended) The apparatus of claim ³⁸ 40, [wherein the bypass robot includes:

an end effector to engage substrates;

a first actuator to vertically translate the end effector;

a second actuator to rotate the end effector about a vertical axis; and

a third actuator to horizontally translate the end effector] wherein at least one of the processing islands includes at least one processing chamber separated from the substrate delivery and removal system.

40 *42.* (Twice amended) An apparatus for performing thin film processing on substrates, comprising:

a plurality of processing islands, each processing island including:

an exterior,

an interior, [and]

at least one load lock chamber having a valve to exchange [a selected one of] the substrates between the exterior and the interior; and

at least one processing chamber;

a substrate delivery and removal system;

a substrate exchange apparatus by which the substrates can be retrieved from the substrate delivery and removal system, introduced into the interior of [a] the plurality of processing islands, extracted from the plurality of processing islands, and returned to the

delivery and removal system; and

at least one substrate buffer chamber to store the substrates prior to or after processing.

43. (Twice amended) An apparatus for performing thin film processing on substrates, comprising:

a substrate holding area;

a plurality of processing islands, each processing island including:

[an exterior, an interior, and]

at least one load lock chamber having a valve to exchange [a selected one of] the substrates between the exterior and the interior; and

at least one processing chamber;

a track passing adjacent to each of said processing islands; and

a substrate exchange apparatus movable along the track to retrieve substrates from the substrate holding area, introduce substrates into the [interior] load lock chamber of a processing island, extract substrates from the processing island, and return substrates to the substrate holding area, wherein the track includes at least two modular tracks with conjunctible interfaces, the track being configured or extended by combining a plurality of said modular tracks, wherein the processing chamber is separated from the substrate exchange apparatus by the load lock chamber.

44. (Twice amended) An apparatus for performing a process on a substrate, comprising:

a conveyor to support a substrate as it moves along a flow path;

a plurality of processing islands located adjacent to said flow path, each processing island including a load lock heating chamber through which a substrate may be introduced into said processing island and in which a substrate can be heated, a processing chamber in which a process may be performed on the substrate after it is heated, and a load lock cooling chamber in which the substrate may be cooled after it has been subjected to the process in said processing chamber; and

a substrate transfer mechanism configured and arranged to transfer the substrate between said conveyor and selected [ones] number of said processing islands, wherein the processing

chamber is separated from the substrate transfer mechanism by at least one of the load lock chambers.

13
45. (Twice amended) An apparatus for performing a process on a number of substrates, comprising:

a conveyor to support the number of substrates along a work flow path at a number of predetermined positions separated by a first pitch;

a plurality of substrate transfer mechanisms configured and arranged to remove the substrates from and place the substrates on said conveyor; and

C 90 Cmt
a plurality of processing islands located along said flow path, at least one of said plurality of processing islands having at least [two adjacent chambers] one load lock chamber and at least one processing chamber disposed adjacent the load lock chamber, wherein said chambers are separated by a second pitch which is[, the second pitch between the adjacent chambers being] substantially the same [equal to] or an [integral] integer multiple of the first pitch [between the predetermined positions on the conveyor].

14 47. (Amended) An apparatus to perform a process on a substrate, comprising:

a substrate processing path having a first end and a second end;

a substrate storage location at [a] the first end of [a] the substrate processing path;

a plurality of process chambers located adjacent [to] the processing path between the first end and [a] the second end of the processing path, wherein at least one of the process chambers is part of a processing island which comprises:

an entry load lock chamber having a first valve through which a substrate can be introduced therein; and

an exit load lock chamber having a second valve through which a substrate can be extracted therefrom; and

a transfer robot movable along the processing path to retrieve a substrate from the substrate storage location[, move it along the processing path] and deliver [it] the substrate to an exchange position in at least one of the load lock chambers [associated with a selected one of the process chambers] from where [it] the substrate can be introduced into the [selected one of the]

plurality of process chambers, wherein the substrate [being] is rotated approximately ninety degrees from the direction of movement along the processing path to the exchange position.

45
48. (Amended) The apparatus of claim 47 wherein the substrate is removed from the selected [one the] process chamber[s] by the transfer robot and rotated approximately ninety degrees before being returned to the storage location.

219
49. (Amended) The apparatus of claim 48 wherein the transfer robot is movable along the processing path in a first direction to deliver the substrate to the exchange position and in a second direction opposite [from] the first direction to return the substrate to the storage location.

50. The apparatus of claim 47 wherein the processing path has a first side and a second side, and the process chambers are located along the first and second sides of the processing path.

51. The apparatus of claim 47 further including a track extending along the processing path on which the transfer robot moves.

52. The apparatus of claim 51 wherein the transfer robot is moveable along the track to a service position where it is accessible for maintenance or replacement, the service position being located at the second end of the processing path.

C.W
53. (Amended) The apparatus of claim 47 wherein [each] at least one of the process chambers is separated from the transfer robot by at least one of the load lock chambers [part of a processing island, the processing island further including: an entry load lock chamber having a first valve through which a substrate can be introduced therein and an exit load lock chamber having a second valve through which a substrate can be extracted therefrom, the process chamber being located between the entry load lock chamber and the exit load lock chamber].

S1
54. (Amended) The apparatus of claim 47 [53] wherein the entry load lock chamber is a heating chamber.

52 55. (Amended) The apparatus of claim 47 [53] wherein the exit load lock chamber is a cooling chamber.

53 56. (Amended) The apparatus of claim 47 [53] wherein the process chambers include one or more chambers configured to perform at least one of a CVD process, a PECVD process, an etching process, a cleaning process, a descumming process, a PVD process, and a post-anneal process.

57. The apparatus of claim 47 wherein the transfer robot includes an end effector to support the substrate, a horizontal linear actuator to horizontally translate the end effector, a vertical linear actuator to vertically translate the end effector, and a vertical rotary actuator to rotate the end effector about a vertical axis.

58. (Amended) An apparatus to perform a process on a substrate, comprising:
a substrate processing path having a first end and a second end;
a means for storing a substrate at [a] the first end of [a] the substrate processing path;
a plurality of process chambers located adjacent to the processing path between the first end and [a] the second end of the processing path;
at least one load lock chamber associated with the process chambers;
a means movable along the processing path for retrieving a substrate from the means for storing [means] and delivering [it] the substrate to an exchange position in the load lock chamber associated with a selected [one] number of the process chambers from where it can be introduced into the selected [one] number of the process chambers, wherein the substrate being moved into the exchange position in a direction that is substantially perpendicular to the processing path.

Please insert new claims 59-86 as follows:

59. An apparatus for performing a process on a substrate, comprising:
a conveyor to support the substrate along a flow path;

a substrate transfer mechanism configured and arranged to remove the substrate from and place another substrate on said conveyor; and

at least one inspection station for inspection of the substrate located adjacent to said flow path, said inspection station having a valve for introduction and extraction of the substrate into and out of an interior thereof.

- C18
C19*
- 51 60. An apparatus for performing a process on a substrate, comprising:
a conveyor to support the substrate along a flow path, wherein said conveyor includes a plurality of substrate holding elements;
a substrate transfer mechanism configured and arranged to remove the substrate from and place another substrate on said conveyor; and
at least one processing island located adjacent to said flow path, said processing island having a valve for introduction and extraction of the substrate into and out of an interior thereof.

- 52*
53 61. An apparatus for performing a process on a substrate, comprising:
a conveyor to support the substrate along a flow path;
a substrate transfer mechanism configured and arranged to remove the substrate from and place another substrate on said conveyor;
at least one processing island located adjacent to said flow path, said processing island having a valve for introduction and extraction of the substrate into and out of an interior thereof; and
at least one substrate stacker to hold substrates prior to or after processing.

- 54*
55 62. An apparatus for performing a process on a substrate, comprising:
a conveyor to support the substrate along a flow path;
a substrate transfer mechanism configured and arranged to remove the substrate from and place another substrate on said conveyor, wherein said substrate transfer mechanism includes an end effector for supporting the substrate, a horizontal linear actuator for horizontally translating the end effector, and a vertical linear actuator for vertically translating the end effector; and

at least one processing island located adjacent to said flow path, said processing island having a valve for introduction and extraction of the substrate into and out of an interior thereof.

63. The apparatus of claim *62*, wherein the end effector is fork-shaped.

64. The apparatus of claim *62*, wherein said substrate transfer mechanism includes a vertical rotary actuator for rotating the end effector about a vertical axis.

65. An apparatus for performing a process on a substrate, comprising:
a conveyor to support the substrate along a flow path;
a substrate transfer mechanism configured and arranged to remove the substrate from and place another substrate on said conveyor; and

at least one processing island located adjacent to said flow path, said processing island having a valve for introduction and extraction of the substrate into and out of an interior thereof;

wherein said substrate transfer mechanism is moveable from a position directly below the substrate on said conveyor when the substrate is in a stopped position adjacent said processing island, to a position engaging the substrate, and then to a final position wherein the substrate is positioned above the conveyor.

66. An apparatus for performing a process on a substrate, comprising:
a conveyor to support the substrate along a flow path;
a substrate transfer mechanism configured and arranged to remove the substrate from and place another substrate on said conveyor; and

at least one processing island located adjacent to said flow path, said processing island having a valve for introduction and extraction of the substrate into and out of an interior thereof;

wherein said processing island includes an entry load lock chamber, a processing chamber and an exit load lock chamber.

67. The apparatus of claim *66*, wherein said entry load lock chamber is a heating chamber and said exit load lock chamber is a cooling chamber.

WS
68.

An apparatus for performing a thin film process on a substrate, comprising:
a conveyor to support a substrate as it moves along a flow path;
a plurality of processing islands located along the flow path, each processing island comprising an exterior, an interior, and at least one valve for exchange of the substrate between the exterior and the interior; and
a substrate exchange apparatus configured and arranged to retrieve a substrate from the conveyor, introduce the substrate into the interior of a selected processing island, extract the substrate from the interior of the selected processing island, and replace the substrate on the conveyor, wherein the substrate exchange apparatus includes:

a first robot for retrieving the substrate from the conveyor and introducing the substrate into the interior of the selected processing island; and

a second robot for extracting the substrate from the interior of the selected processing island and positioning the substrate on the conveyor.

*C13
Claim 69.*

An apparatus for performing a thin film process on a substrate, comprising:
a conveyor to support a substrate as it moves along a flow path;
a plurality of processing islands located along the flow path, each processing island comprising an exterior, an interior, and at least one valve for exchange of the substrate between the exterior and the interior; and
a substrate exchange apparatus configured and arranged to retrieve the substrate from the conveyor, introduce the substrate into the interior of a selected processing island, extract the substrate from the interior of the selected processing island, and replace the substrate on the conveyor, wherein the substrate exchange apparatus includes:

a loader having an end effector for retrieving the substrate from the conveyor and introducing the substrate into the interior of the selected processing island; and

an unloader having an end effector for extracting the substrate from the interior of the selected processing island and positioning the substrate on the conveyor.

WS
70.

The apparatus of claim 69, wherein the end effector has the shape of a fork.

66

71. An apparatus for performing a thin film process on a substrate, comprising:
a conveyor to support a substrate as it moves along a flow path, wherein the flow path is a continuous loop;
a plurality of processing islands located along the flow path, each processing island comprising an exterior, an interior, and at least one valve for exchange of the substrate between the exterior and the interior; and
a substrate exchange apparatus configured and arranged to retrieve the substrate from the conveyor, introduce the substrate into the interior of a selected processing island, extract the substrate from the interior of the selected processing island, and replace the substrate on the conveyor.

69

72. An apparatus for performing a thin film process on a substrate, comprising:
a conveyor to support a substrate as it moves along a flow path, wherein the conveyor has a plurality of individual holding elements, each for holding a substrate;
a plurality of processing islands located along the flow path, each processing island comprising an exterior, an interior, and at least one valve for exchange of the substrate between the exterior and the interior; and
a substrate exchange apparatus configured and arranged to retrieve the substrate from the conveyor, introduce the substrate into the interior of a selected processing island, extract the substrate from the interior of the selected processing island, and replace the substrate on the conveyor.

70

69

73. The apparatus of claim 72, wherein the pitch between adjacent individual holding elements and the pitch between adjacent chambers in a processing island is substantially uniform.

71

70

74. The apparatus of claim 73, wherein the pitch between adjacent individual holding elements is substantially equal to the pitch between adjacent chambers in each of said plurality of processing islands.

12 75. The apparatus of claim *73*, wherein the pitch between adjacent individual holding elements is substantially equal to the pitch between adjacent chambers in at least one of said plurality of processing islands.

13 76. The apparatus of claim *72*, wherein each holding element is formed as a pallet configured to centrally support a substrate, and the substrate exchange apparatus includes at least one frame for supporting the substrate about a perimeter thereof, the frame configured to be moved from a first position below the pallet to a second position above the pallet for acquiring the substrate from the pallet, the frame having a perimeter gap to permit passage of a pallet support element during exchange of the substrate between the pallet and the frame.

14 77. The apparatus of claim *72*, wherein each holding element has a C-shaped structure with a first substrate holding moiety forming a top of the C-shaped structure.

15 78. An apparatus for performing thin film processing on substrates, comprising:
at least one processing island arranged along a work flow path, wherein the processing island including an exterior, an interior, and at least one valve for exchange of a selected one of the substrates between the exterior and the interior;
a substrate delivery and removal system, wherein the substrate delivery and removal system includes:

a plurality of cassettes to hold a plurality of substrates; and

a cassette loading system to position the substrates on the cassettes; and

a substrate exchange apparatus to retrieve the selected one of the substrates from the substrate delivery and removal system, introduce the selected one of the substrates into the interior of the processing island, extract the selected one of the substrates from the processing island, and return the selected one of the substrates to the delivery and removal system;

wherein the substrate exchange apparatus is moveable along the work flow path between a first position at which the selected one of the substrates can be retrieved from the delivery and removal system, or returned to the delivery and removal system, and an exchange position at

which the selected one of the substrates can be transferred between the interior and exterior of the processing island.

74
79. An apparatus for performing thin film processing on substrates, comprising:

a plurality of processing islands arranged along a work flow path, wherein each processing island includes an exterior, an interior, and at least one valve for exchange of a selected number of the substrates between the exterior and the interior;

a substrate delivery and removal system; and

a substrate exchange apparatus to retrieve the selected number of the substrates from the substrate delivery and removal system, introduce the selected number of the substrates into the interior of the processing island, extract the selected number of the substrates from the processing island, and return the selected number of the substrates to the delivery and removal system;

wherein the substrate exchange apparatus is moveable along the work flow path between a first position at which the selected number of the substrates can be retrieved from the delivery and removal system, or returned to the delivery and removal system, and an exchange position at which the selected number of the substrates can be transferred between the interior and exterior of the processing island;

wherein each processing island includes:

a first load lock chamber having a first valve through which the selected number of the substrates can be introduced therein; and

at least one processing chamber;

wherein for each processing island, said substrate exchange apparatus may be moved to at least one exchange position to introduce the selected number of the substrates into the first load lock chamber.

75
80. The apparatus of claim *79*, wherein said processing chamber includes one or more chambers configured to perform at least one of a CVD process, a PECVD process, an etching process, a cleaning process, a descumming process, a PVD process, a post-anneal process, or a combination thereof.

- 78
81. An apparatus to perform a process on a substrate, comprising:
a substrate storage location at a first end of a substrate processing path;
a plurality of process chambers located adjacent to the processing path between the first end and a second end of the processing path; and

a transfer robot movable along the processing path to retrieve a substrate from the substrate storage location, move the substrate along the processing path, and deliver the substrate to an exchange position associated with a selected one of the process chambers from where the substrate can be introduced into the selected one of the process chambers, wherein the substrate is rotated approximately ninety degrees from the direction of movement along the processing path to the exchange position;

wherein the substrate is removed from the selected one of the process chambers by the transfer robot and rotated approximately ninety degrees before being returned to the storage location.

- 79
82. The apparatus of claim 81 wherein the transfer robot is movable along the processing path in a first direction to deliver the substrate to the exchange position and in a second direction opposite the first direction to return the substrate to the storage location.

- 80
83. An apparatus to perform a process on a substrate, comprising:
a substrate storage location at a first end of a substrate processing path;
a plurality of process chambers located adjacent to the processing path between the first end and a second end of the processing path; and
a transfer robot movable along the processing path to retrieve a substrate from the substrate storage location, move the substrate along the processing path, and deliver the substrate to an exchange position associated with a selected one of the process chambers from where the substrate can be introduced into the selected one of the process chambers, wherein the substrate is rotated approximately ninety degrees from the direction of movement along the processing path to the exchange position;

wherein the processing path has a first side and a second side, and the process chambers

are located along the first and second sides of the processing path.

84.

An apparatus to perform a process on a substrate, comprising:
a substrate storage location at a first end of a substrate processing path;
a plurality of process chambers located adjacent to the processing path between the first end and a second end of the processing path;
a transfer robot movable along the processing path to retrieve a substrate from the substrate storage location, move the substrate along the processing path, and deliver the substrate to an exchange position associated with a selected one of the process chambers from where the substrate can be introduced into the selected one of the process chambers, wherein the substrate is rotated approximately ninety degrees from the direction of movement along the processing path to the exchange position; and
a track extending along the processing path on which the transfer robot moves

85.

The apparatus of claim 84 wherein the transfer robot is moveable along the track to a service position where it is accessible for maintenance or replacement, the service position being located at the second end of the processing path.

86.

An apparatus to perform a process on a substrate, comprising:
a substrate storage location at a first end of a substrate processing path;
a plurality of process chambers located adjacent to the processing path between the first end and a second end of the processing path; and
a transfer robot movable along the processing path to retrieve a substrate from the substrate storage location, move the substrate along the processing path, and deliver the substrate to an exchange position associated with a selected one of the process chambers from where the substrate can be introduced into the selected one of the process chambers, wherein the substrate is rotated approximately ninety degrees from the direction of movement along the processing path to the exchange position;

wherein the transfer robot includes an end effector to support the substrate, a horizontal linear actuator to horizontally translate the end effector, a vertical linear actuator to vertically